

Making Sense of the Changing Global Supply Landscape

New Rules and Reformulations

Carole LeBlanc, Ph.D. ■ Shannon Cunniff

The global nature of military supply chains means that evolving chemical regulations throughout the world are triggering product reformulations and affecting the work of acquisition professionals. When defense contractors purchase from, and build for, a global market, the most stringent chemical regulations in the supply network drive the availability, use, and disposal of constituent materials in weapon systems and equipment. How can acquisition professionals successfully adapt to this changing global landscape?

The Law of Unintended Consequences

Currently, the most stringent chemical regulation is the European Union's (EU's) REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals) regulation. Although in its early stages of implementation, it is already driving product reformulations across the globe as industries move away from using known hazardous materials to inherently more benign ones. REACH, and other evolving international chemical regulations will increasingly affect the cost, performance, and schedule of weapons acquisition programs due to product reformulations.

For example, in July 2006, the EU promulgated a new regulation entitled "Restriction of Hazardous Substances" (RoHS), which limits the use of lead, mercury, cadmium, hexavalent chromium, and other chemicals in products. The restriction on lead prompted manufacturers to switch to lead-free solder alloys and pure tin termination finishes in a broad array of electronic equipment. Pure tin finishes develop "whiskers" that can short-circuit crucial electronics in aircraft and other critical military applications; and the reliability

LeBlanc, the technical advisor to CMRM, is the former director of the Surface Solutions Laboratory of the Toxics Use Reduction Institute at the University of Massachusetts. She has conducted international applications development for pharmaceuticals, including sarcoma vaccine adjuvants for AIDS patients and hepatitis vaccine manufacture for the People's Republic of China. **Cunniff** is director of the Chemical and Material Risk Management Directorate (CMRM) of the Office of the Under Secretary of Defense, AT&L (Installations and Environment). She has also worked for the EPA, the Bureau of Reclamation, and the Army Corps of Engineers, where she worked on projects spanning water resources planning, management, and restoration.

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of lead-free solder alloys has not been proven in military and aerospace applications.

As a result, a major re-evaluation of military electronics has been launched and a new Army policy was developed that requires lead-based solder and finishes to be used in electronics. The director of the Office of the Assistant Secretary of Defense for Research & Engineering is identifying research requirements to understand the severity of the threat to the DoD mission and develop substitutes for leaded solder. Industrial partners most familiar with this issue have suggested an initial \$100 million research effort in partnership with DoD and other agencies to address performance concerns.

Far more sweeping than RoHS, the EU's REACH regulation went into effect June 1, 2007. REACH replaces some 40 pre-existing laws in the EU Member States and neighboring countries. The goal of REACH is to register as many as 30,000 chemicals in 10 years with the ultimate purpose of authorizing or, alternatively, banning the use of a given chemical for a given application.

Originally conceived as a consumer protection law, REACH was promulgated to assess and limit the risks posed by exposure to hazardous chemicals, essentially asking the question: Is the use of a specific chemical warranted, given its inherent risks? The "burden of proof" for product safety is placed on the manufacturer. Under the REACH regulation, authorization is required to use substances of very high concern including: those that are carcinogenic, mutagenic or toxic to reproduction (CMR); persistent, bioaccumulative, and toxic (PBT) or very persistent and very bioaccumulative (vPvB) substances; and those causing probable serious effects to humans or the environment identified on a case-by-case basis, such as endocrine disrupters. Risks must be adequately controlled or a demonstration made that the benefits of using these substances outweigh the risks and no alternatives exist.

For consumers, REACH will undoubtedly lead to safer products over time. However, the extent to which the expedited adoption of alternate substances and articles will pose performance issues for defense-related systems remains to be seen. The REACH regulation does not contain a blanket exemption for substances necessary to the interest of military defense. Military exemptions must be pursued on a case-by-case basis by individual ministries of defense (MODs) within the EU.

"No Data, No Market"

The REACH regulation requires industry to demonstrate the safety of chemicals for each use before they can be made, sold, or imported in the EU. In some cases, smaller companies may decide to abandon a market rather than undergo the expense of obtaining this information. In other cases, changes in product formulation may occur without the knowledge or consent of DoD or the original equipment manufacturer, thus, posing technical performance issues (similar to the impact of the RoHS constraint on use of lead) as well as cost and schedule impacts. REACH will drive corporations, both manu-

DoD REACH Strategic Plan Goals to Preserve and Enhance Military Readiness:

- Protect the Availability of Chemicals with Significance to the Mission
- Ensure the Performance of Substitute Chemicals with Significance to the Mission
- Guard Against Disruptions to the Defense Supply Chain
- Facilitate Defense Exemptions as Necessary
- Minimize Negative Impacts to Foreign Military Sales
- Assure that Defense Acquisition Strategies Meet Today's and Tomorrow's Warfighter Needs
- Capitalize on Environment, Safety and Health Opportunities
- Capitalize on Chemical Management Opportunities
- Plan for Future Regulations Impacting Chemical Use, Safety, and Availability

facturers and downstream users, to new levels of supply chain management and accountability. While the United States is not subject to REACH compliance, many of DoD's industrial suppliers will be.

What the Acquisition Professional Needs to Know and Do

Multiple DoD components and commands will need to anticipate and respond to these complex chemical regulations to ensure the warfighter remains supplied and ready. To promote military readiness, the principal deputy under secretary of defense for AT&L issued a strategic plan for REACH in July 2010 (http://www.denix.osd.mil/cmrmdupload/REACH_Strat_Plan_Signed.pdf).

The plan's nine goals aim to manage both the foreseeable and unforeseen impacts of REACH and leverage the opportunities REACH presents to reduce the total ownership (or life cycle) costs of existing and new DoD weapon systems and platforms. Each acquisition professional must identify and consider the risks associated with material choices in light of REACH regulatory requirements, shifting availability and material costs, and the possibility of chemical reformulations within the global supply chain. In an existing weapon system or platform, material choices may include the continued use of a REACH-regulated chemical or the adoption of a substitute chemical due to REACH restrictions. For new weapon systems and platforms, the relative risks of selecting a REACH-regulated versus a substitute chemical should be evaluated. Acquisition professionals must be especially alert to possible sustainment and transport issues, including compatibility of substances and articles with

equipment used by NATO defense alliance, and implications for foreign military sales pursued by DoD suppliers.

Where and how reformulated and substitute chemicals and materials are, or may be, used in existing weapon systems and platforms must first be established to ensure continued trust in their performance. Once this is determined, the impacts from using reformulated and substitute chemicals and materials can be assessed using a life cycle approach. For example, a substitute chemical, such as a lubricant, may meet performance requirements but degrade more rapidly, causing more frequent system maintenance to be required. Also, substitute chemicals may require process changes for their use; a substitute chemical may require a multi-step process to do what was previously done in one step. These types of impacts must be considered during the life cycle analysis.

Greater investments in testing and validating reformulations and alternate substances to ensure they meet performance standards will be required to comply with REACH. For instance, significant efforts are underway to test and qualify alternatives for hexavalent chromium-based materials used for corrosion prevention. In a recent case involving medium caliber gun barrels, research resulted in the development and testing of a tantalum/tungsten (10 percent) alloy coating bonded to the inner surface of the gun barrel. Gunfire testing demonstrated that the new coating extends the life of the barrel two- to three-fold, and may make it possible to use more energetic, higher-temperature propellants.

Furthermore, modifications to certain product performance specifications to prohibit the use of certain chemicals and substances or those that exhibit unwanted characteristics may be warranted to aid DoD in addressing REACH requirements. Performance specifications presently place few limitations on chemical formulations. For example, the formulation of a degreaser for DoD is typically dictated only by its performance as a cleaner. Any ingredient, even one that is a carcinogen or a flammable agent, may be used. The failure to prohibit these kinds of chemicals in these kinds of products has resulted in a wide range of chemical compositions being supplied under one national stock number/specification, some of which may contain ingredients that are not desirable and may not even be required for acceptable performance.

To ensure the integrity of weapons systems, protect supply chains, and guarantee uninterrupted support to the warfighter, acquisition and supply chain professionals need to stay informed and improve their understanding of the chemicals and materials used in or on DoD products and systems. DoD's strategic plan for REACH is geared toward identifying and minimizing disruptions to cost structures, schedules, and performance of the weapons systems and other equipment developed through the acquisition process.

One way to avoid long-range supply and acquisition disruptions is for DoD to consider the impact of REACH during the

development of sustainment requirements for new weapon systems and platforms. The DoD has defined three mandatory requirements to ensure that effective sustainment is addressed and accomplished over the life cycle of all newly developed and fielded systems. These requirements include a key performance parameter (KPP), availability; and two key system attributes (KSAs), reliability and ownership cost. The availability KPP can be defined two ways—as the percentage of the total inventory of a system capable of performing its assigned mission at a given time or the percentage of time a system is operationally capable of performing. The probability a system will perform without failure over a specified interval and conditions is defined by the reliability KSA, while the ownership KSA considers operations and support costs over the lifespan of the system. Failure to adequately consider the potential impacts of REACH on these sustainment requirements could lead to increased system life-cycle costs and/or reduced system availability to the warfighter.

If a system under consideration is expected to use a chemical or substance regulated by REACH, the impacts of its use on the system's sustainment requirements should be considered as early as possible to help determine if its use is warranted or if design modifications should be considered. While this may require new approaches, careful research, and attention to changing regulations, the benefits for long-term sustainment of DoD assets may be significant. Considering the impact of regulations such as REACH on the sustainment of future DoD weapon systems and platforms may create a path to successfully meet KPPs/KSAs despite regulatory shifts that may occur over their life cycle. Life cycle environment, safety, and maintenance costs could be reduced and the potential for unintended consequences such as those that emerged with "whiskers" in tin solder and finishes be lowered.

The best way to manage risks is to lessen and avoid, to the maximum extent practicable, the planned use of hazardous and toxic chemicals. REACH presents opportunities to further green the supply chain and the systems acquisition process. DoD intends to capitalize on these opportunities through the use of high-performing substitutes and improved chemical management as it addresses these new challenges.

Resources for the Acquisition Professional

Tapping into REACH-associated updates from OSD (<http://www.denix.osd.mil/cmrm/ChemicalManagement/TSCA.cfm>) and DoD's European Command (EUCOM) may help acquisition professionals anticipate cost and availability shifts of key materials and chemicals and ensure time for performance testing of viable substitutes. AT&L supply chain professionals can keep abreast of EUCOM, who is leading coordination of chemical-specific defense exemptions, as they communicate their positions. EUCOM, in collaboration with the EU's Defense Network (DEFNET), will track the positions of the MODs for the individual EU member states regarding implementation of REACH and requests for military exemptions. DEFNET helps the MODs ensure that defense interests are appreciated dur-

REACH in a Nutshell

Registration is required for all substances manufactured or imported in quantities of 1 metric ton or more per year, unless they are explicitly exempted from the scope of registration. The authorization step is required for "substances of very high concern," and restrictions will be placed on substances when unacceptable risks to human health or the environment have been identified. The first step in the authorization process is placing substances of very high concern on a candidate list for further evaluation. After the evaluation, regulatory decisions are made about potential bans or restrictions on certain applications.

ing the development of European environmental legislation, through the provision and exchange of technical information.

In addition, the Chemical and Material Risk Management Directorate (CMRMD) of the Office of the Under Secretary of Defense, AT&L (Installations and Environment) identifies and analyzes chemicals and materials with changing regulatory profiles. Information on risks evaluated by CMRMD is reported to acquisition and environment, safety, and occupational health (ESOH) professionals on the Acquisition Community Connection (<https://acc.dau.mil/CommunityBrowser.aspx>) and DENIX/CMRMD (<https://www.denix.osd.mil/portal/page/portal/CMRMD>) websites.

Another resource soon to be available via DAU is a course titled "Strategic Material Selection," which will provide infor-

mation on useful chemical ranking tools for acquisition professionals to select component materials. This course will help support making strategic acquisition decisions that address the life cycle issues.

Conclusion

Evolving chemical regulations can affect DoD weapon system acquisition and sustainment processes through subtle, or sometimes significant, changes to cost, performance, and scheduling criteria. Still, DoD and other organizations can capitalize on the opportunities presented by regulations such as REACH to green the military supply chain and acquisition process by developing high-performing substitutes and implementing improved chemical management processes.

The availability of chemical information not required under U.S. law, but required by REACH, will influence acquisition managers' decisions about ESOH risks and life cycle costs associated with a chemical's use in a weapons system. The rewards of better informed decisions for chemical selection and usage will serve the DoD mission today and tomorrow. Using a life cycle approach, in combination with anticipating regulatory developments at the international, national, and state levels, will inform chemical usage decisions made by the DoD today, and promote readiness tomorrow. Enterprise-wide management of the selection, acquisition, distribution, use, and disposal of chemicals would better prepare DoD for future regulatory initiatives.

The authors can be contacted at shannon.cunniff@osd.mil and carole.leblanc@osd.mil.

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